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CRITICAL REVIEW OF THE TAXONOMIC STATUS OF
MEDITERRANEAN *PHYLLIDIA* (OPISTHOBRANCHIA:
NUDIBRANCHIA: DORIDOIDEA)**

KEY WORDS: Opisthobranchia, Nudibranchia, Phyllidiidae, *Phyllidia*, taxonomy, Mediterranean Sea.

Summary

Examination of literature and specimens indicates that only one biological species of *Phyllidia* exists in the Mediterranean Sea. Five taxonomically available names already exist for it: *Phyllidia flava* ARADAS, 1847; *P. papillosa* ARADAS, 1847; *P. rolandiae* PRUVOT-FOL, 1951; *P. aurata* PRUVOT-FOL, 1952; *P. pulitzeri* PRUVOT-FOL, 1962. *Phyllidia flava* is selected as the senior synonym under the first reviser rule. A neotype is designated for *P. flava* in order to fix it and *P. pulitzeri* as objective synonyms. *Phyllidia depressa* ARADAS, 1847 is herein considered unrecognizable. An appendix contains an English translation of the Italian text of Aradas' paper.

Riassunto

Dall'esame della letteratura e di esemplari risulta che in Mediterraneo vive una sola specie biologica di *Phyllidia*. Esistono tuttavia cinque nomi tassonomicamente disponibili; *Phyllidia flava* ARADAS, 1847; *P. papillosa* ARADAS, 1847; *P. rolandiae* PRUVOT-FOL, 1951; *P. aurata* PRUVOT-FOL, 1952; *P. pulitzeri* PRUVOT-FOL, 1962. Come sinonimo seniore, in base al principio del primo revisore, viene scelta *Phyllidia flava*, di cui viene designato un neotipo, con *P. pulitzeri* come sinonimo oggettivo. *Phyllidia depressa* ARADAS, 1847 non ci risulta identificabile. In appendice viene presentata una traduzione in inglese del testo italiano di Aradas.

In 1847, Andrea ARADAS described three Mediterranean nudibranchs belonging to Cuvier's genus *Phyllidia* - *P. papillosa*, *P. flava* and *P. depressa*. All three species originated from Sicily. Aradas' descriptions, which were in Italian with Latin diagnoses, dealt only with external features and there were no illustrations. Due to the obscurity of this publication, and because it has been so long overlooked plus the importance of the contained descriptions, we feel it would be beneficial to provide an English translation of the Italian sections of Aradas' full «Articolo II» (Appendix 1). That Ara-

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das' new species belong to the genus *Phyllidia* is absolutely certain from the two paragraphs preceding their descriptions. *Phyllidia papillosa* appears on page 120, and *P. flava* and *P. depressa* follow each other on page 121.

One hundred and four years later, Alice PRUVOT-FOL described as new «*Phyllidia* (?) *rolandiae*» PRUVOT-FOL, 1951 on the basis of one 30 mm unlocalized specimen. She later (PRUVOT-FOL, 1954: 329) stated that the specimen came «probably from the Spanish coast near to Banyuls, at the time of a scientific cruise by the vessel *Roland*» (translated from the French). A photograph (PRUVOT-FOL, 1951: 38, Figure 20) of the preserved specimen and sketches of its external and internal anatomy accompanied her original description (PRUVOT-FOL, 1951). Subsequently, in her monograph on French opisthobranchs, Pruvot-Fol presented a condensed description and new illustrations of *P. rolandiae* (PRUVOT-FOL, 1954: 328, 329, Figure 129, nos a-f). The holotype of *P. rolandiae* cannot now be located in the Muséum National d'Histoire Naturelle, Paris, and must be presumed lost (P. BOUCHET, pers. comm., 1987).

In 1952, Pruvot-Fol described another new Mediterranean *Phyllidia*, *P. aurata* PRUVOT-FOL, 1952. The specimen measured 18 mm preserved. It had been collected by her son, G. Pruvot, whilst diving at 45 m near Cannes, France. The description was accompanied by sketches of external features and internal anatomy, and later photographs (PRUVOT-FOL, 1956: 80, Figure 9). In this latter reference, the publication date was given erroneously as 1954. The holotype is in the Muséum National d'Histoire Naturelle, Paris.

Pruvot-Fol described a third new Mediterranean *Phyllidia* ten years later, «*Phyllidia* (ou de *Phyllidiopsis*) *pulitzeri*» PRUVOT-FOL, 1962. Like both her two previous species, *P. pulitzeri* was based only on a single preserved individual. This holotype, which was subsequently lost, came from Portofino, Italy and its description was accompanied by sketches of external features. WÄGELE (1985: 65) designated a neotype for *P. pulitzeri*, which is deposited, together with a colour slide (reproduced here in Figure 1), in the Muséum National d'histoire Naturelle, Paris. This neotype originated from Gozo Island, Malta and measures 20 mm preserved length.

Pruvot-Fol was apparently unaware of Aradas' pre-existing names or descriptions, because on no occasion did she mention them.

In recent times a considerable number of *Phyllidia* specimens have been taken by divers in the northwestern Mediterranean (BARLETTA, 1974a, 1974b; BARLETTA & MELONE, 1976; ROS, 1976, 1980; CATTANEO, 1982; CIMINO et. al., 1982; SCHMEKEL & PORTMANN, 1982; PERRONE, 1983, 1985; CATTANEO & BARLETTA, 1985; WÄGELE, 1984, 1985; MACRI, 1985, 1986; CATTANEO VIETTI & CHEMELLO, 1987). Most authors merely recorded the species' occurrence but PERRONE (1983) provided drawings of external features and spicules and WÄGELE (1984, 1985) presented a detailed account of anatomy and histology. Coloured illustrations were given by BARLETTA (1974a), SCHMEKEL & PORTMANN (1982), MACRI (1986) and WÄGELE & SCHMINKE (1987).

With the exception of PERRONE (1983, 1985), all these recent specimens have been identified as *Phyllidia pulitzeri*, not because of the completeness of the original description of that species, but apparently simply because it is the most recently produced name.

Material

In 1987, we wrote to the following Italian museums in an attempt to relocate Aradas' specimens: Museo di Roma; Museo Civico di Zoologia, Roma; Museo Civico di Storia Naturale «Giacomo Doria», Genova; Museo Civico di Storia Naturale, Venezia; Museo Civico di Storia Naturale, Milano; Società Adriatica di Scienze, Trieste. All these attempts were unsuccessful. G. Arbocco informed us that the bulk of Aradas' molluscan collections are in the Società Italiana di Scienze Naturali, Milano (where they were bequeathed by the widow of O. Priolo), but two requests to the Director of that institution were fruitless. Therefore we must conclude Aradas' *Phyllidia* specimens are all lost.

We examined the only surviving holotype of Pruvot-Fol's three Mediterranean *Phyllidia* species, that of *P. aurata*. In addition we examined Wägele's neotype of *P. pulitzeri*. And finally, we examined five recently collected Mediterranean specimens including colour transparencies of living animals kindly sent by R. Cattaneo-Vietti and H. Wägele (Figures 1 and 2). Actually one of our specimens came from Palermo, Sicily, which is the type locality for all three of Aradas' nominal species. Table 1 provides a summary of all the specimens we examined during the course of this study. In view of this number of *Bollettino Malacologico* being issued in memoriam for Giorgio Barletta, it is appropriate to acknowledge him as the collector of the 27 mm specimen from Monaco.

Table 1. List of *Phyllidia* specimens examined from the Mediterranean Sea.

Specimen	Preserved Length (mm)	Depth (m)	Locality	Date
1. (= <i>Phyllidia aurata</i> holotype)	18	45	Cannes, France	1952
2.	27	30	Monaco	9 July 1980
3.	19	20	Portofino, Italy	8 Jan. 1981
4.	21	20	Portofino, Italy	24 Jan. 1981
5.	17	8	Gozo, Malta	28 March 1983
6. (= <i>Phyllidia pulitzeri</i> neotype)	20	5-30	Gozo, Malta	May 1983
7.	19	—	Cape Zafferano, Gulf of Palermo, Sicily	1985

Results

Although Aradas' descriptions of his Sicilian phyllidiids were relatively brief by modern standards, there is no doubt of their availability. All Aradas' specimens can unquestionably be recognized as belonging to the genus *Phyllidia* on account of their shape, rigid body, and the form and position of the gills. The notum of all of them was described as flattened

and convex, and covered with numerous tubercles. Two of them, *P. flava* and *P. papillosa*, were bright yellow in colour and the third, *P. depressa*, was dark yellow.

Our examinations of Mediterranean *Phyllidia* revealed negligible variation, neither between the specimens themselves nor with the published descriptions. The specimens' shape, texture and colour correspond to Aradas' and Pruvot-Fol's descriptions. Moreover, we noted four important characters which we consider to be species-specific; these are colour, notal tubercles, mantle spicules and reproductive morphology. In life, the colour of the notum, foot and tubercles is golden-yellow, and the larger tubercles are contrastingly white. In fact, all specimens have two sets of notal tubercles; larger, broader, rounded white ones and smaller, more numerous, conical yellow ones, both types being interspersed with each other (Figures 1 and 2). In life too, all specimens possess a skeletal network formed from massed, lanceolate spicules within the mantle (figured by PERRONE, 1983). These spicules also support the notal tubercles. PERRONE (1985) denied such spicules were present in one specimen that he attributed to *P. pulitzeri*. However we have observed them in every specimen we have studied and we suspect that Perrone accidentally overlooked them due to their fineness in his small animal or possibly through dissolution by the fixative or preservative fluids that he used. WÄGELE (1985) has provided a generalized view of the reproductive system of this species. We could recognize rows of minute spines within the distal penial duct in all the specimens we dissected despite Wägele's claim of an unarmed penis. However Wägele has now informed us that her specimens possibly did have penial spines (H. WÄGELE, pers. comm. 1987). Again, these spines might have been dissolved by the fixative or preservative that she used.

The distinction between tubercle types we mentioned above (i.e., large, broad white ones and small, conical yellow ones) cannot be noticed in the preserved animals. Preservation appears to cause several changes in the tubercles. Some become higher and/or broader and others collapse almost to the point of flattening out. We attribute the differences in the form of the notal tubercles that PRUVOT-FOL (1962) invoked to distinguish between *Phyllidia aurata* and *P. pulitzeri* as artefacts of preservation. No such variability was detectable in photographs of living animals that we examined. WÄGELE's (1985) observations support our view. She noticed that, although living animals of different sizes showed no intraspecific variability in the size or form of their tubercles, preserved ones displayed considerable variation in these same morphological characters. In addition, the glassy, brownish spherules recognized by PRUVOT-FOL (1962) on *P. pulitzeri* are undoubtedly artefacts too. These spherules are actually crystallized mucus. Both WÄGELE (1985) and ourselves have observed them on some specimens but not others. In the case of our own material, they were noticed on only the 19 mm specimen from Portofino.

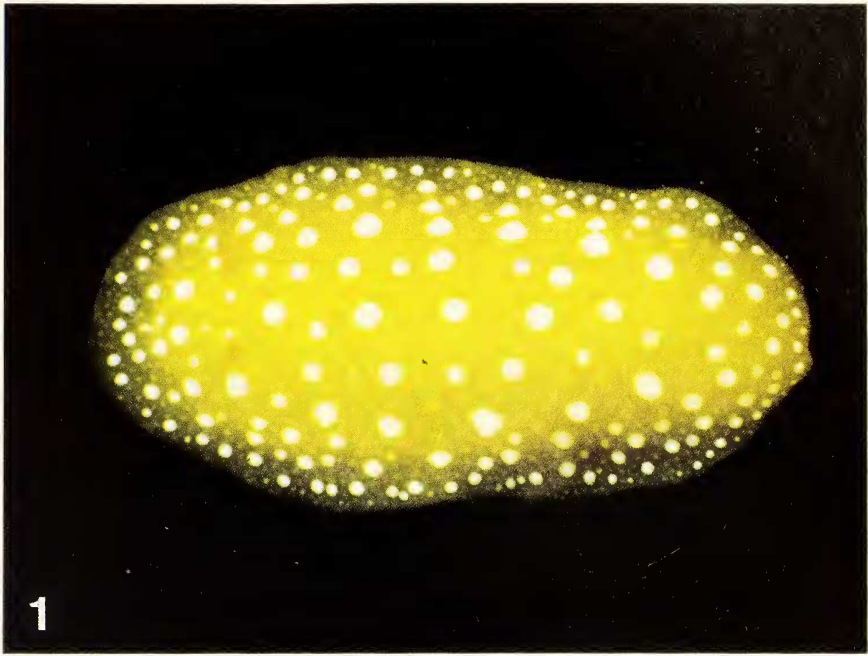


Figure 1. *Phyllidia flava* ARADAS. 5-30 m, Gozo, Malta, May 1983. Photograph: H. Wägele. Specimen shown is neotype for both *P. flava* ARADAS and *P. pulitzeri* PRUVOT-FOL.



Figure 2. *Phyllidia flava* ARADAS. 6 m, Zaffiro Cave, Sorrentine Peninsula, Italy, May 1979. Photograph: R. Cattaneo-Vietti.

Conclusion

The only taxonomic characters presented in the past to distinguish between any of the six nominal species of Mediterranean *Phyllidia* have been the nature of the notal tubercles and the presence or apparent absence of spicules within the mantle.

We believe there is ample evidence to conclude at least five of the six nominal species of Mediterranean *Phyllidia* introduced between 1847 and 1963 are synonyms representing only one biological species. The strongest arguments in our favour are coloration and notal form of living animals. Form of the notal tubercles has already been discussed. The Mediterranean species is distinctive in its uniform golden-yellow livery of notum, foot and tubercles, the larger ones of which are contrastingly white (Figures 1 and 2). The absence of any black pigment renders this species unique within the genus *Phyllidia*.

Because of its reported size (79 mm) and dark coloration, we have hesitated in incorporating the third of ARADAS' (1847) species, *Phyllidia depressa*, into the synonymy above. We suspect that either *P. depressa* was a particularly large, dark animal or that Aradas' description was inaccurate. The description, by itself, could hardly lead to recognition of the species. However it is wisest to leave this name out of the synonymy at present. Perhaps future Mediterranean collectors will rediscover this animal and establish its identity (most probably) as that of the species dealt with in this paper.

The view that there is only one Mediterranean *Phyllidia* species is supported by most local, modern day opisthobranch workers (CATTANEO-VIETTI & CHEMELLO, 1987; R. CATTANEO-VIETTI, pers. comm., 1986, 1987; H. WÄGELE, pers. comm., 1987, J.C. GARCIA and J.L. CERVERA, pers. comm. 1987).

ARADAS' (1847) names are unquestionably available, and, at least for the first two, the descriptions are perfectly recognizable. Therefore one of them must stand as the senior synonym. Acting as first revisers, we select the name *Phyllidia flava* ARADAS, 1847 to stand as the name for this species (ICZN, 1985 Article 24 (a)). We choose this name with the desire for future stability uppermost; it is appropriately descriptive in terms of colour («flava» is the Latin adjective for golden-yellow or yellow) and the name which immediately precedes it, *P. papillosa*, is so close in phonetics and spelling to *P. pustulosa* CUVIER that its choice would propogate confusion.

In addition, and with the knowledge that Aradas' holotypes are probably lost, we hereby designate as neotype for *P. flava* the 20 mm specimen from Malta that WÄGELE (1985: 65) designated as neotype for *P. pulitzeri* (Figure 1). This action fixes *P. flava* ARADAS and *P. pulitzeri* PRUVOT-FOL as objective synonyms.

It is unlikely any author could argue for establishment of any of Pruvot-Fol's three names as the senior synonym for the four following reasons: (1) they were introduced over a century later than those of Aradas; (2) their synonymy has not been recognized previously; (3) the general usage of *pulitzeri* for the species has been maintained for just over 20 years; (4) the description of the first species, *Phyllidia rolandiae*, is inadequate. However, with regard to the final point, we must close by correcting one nomenclature

latural statement made by WÄGELE (1985). She considered *P. rolandiae* to be a nomen dubium and in doing so confused the availability of the name for taxonomic purposes with the recognizability of the taxon as a biological entity distinct from other Mediterranean *Phyllidia*. Despite its imperfections, Pruvot-Fol's description of *P. rolandiae* is certainly sufficient to render that name available under the requirements of the International Code of Zoological Nomenclature. Therefore it can contend as a synonym, not only of Pruvot-Fol's other two names, but also of Aradas' names.

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Appendix 1. English translation of Aradas' (1847) work on Sicilian *Phyllidia*.

Comments in square brackets have been inserted by the present authors.

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ARTICLE II.

Description of three new species of molluscs belonging to the genus *Phyllidia* of Cuvier.

No species of this genus has been found before in the seas of the kingdom of Sicily, nor the kingdom of Napoli. None of the zoologists who worked on compiling the Sicilian and Neapolitan malacological faunas has made mention of the genus.

When I visited Palermo in 1843, staying there over a month, I obtained various nudibranchs, among which, after studying them carefully in the course of time, I found some species belonging to the above-mentioned genus. It was indeed a discovery that, from the beginning and not without reason, I thought useful to the malacological fauna mentioned before. However, my satisfaction grew enormously when, on comparing the species discovered by myself with the others previously described, or at least with the ones of which I was able to have knowledge, I found them to be very different from those, and I decided to provide an exact description of them.

However, before I start describing them, I think that it is fair to mention the characteristics of the genus to which they belong.

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Gen. *Phyllidia* Cuv.

Thanks to the great Cuvier we know this genus, in which the anal position is similar to dorids, but for the shape and position of the gills, it seems to be close to chitons and limpets, yet these have a shell and *Phyllidia* lacks one. Phyllidiids are naked and the body is covered by a generally coriaceous skin. The gills, which are formed by a row of closed leaflets, are present under the mantle around the body. The mouth, as Lak [i.e., Lamarck] said, is placed on the lower part of the head and it possesses two small, conical tentacles. The mantle, which covers the head completely, possesses two holes for the superior tentacles dorsally, and the anal aperture is located posteriorly. The reproductive apertures are located on the right side.

Also, despite my modest knowledge, I believe the molluscs which I am studying to be new, and they were studied after a period of conservation in spirit. I say this to advise that the observations are not very accurate as regards the living state. Nevertheless, they do possess characteristics sufficient to distinguish between them.

Species I.

Phyllidia papillosa. mihi.

«Ph. corpore ovato-elliptico, depresso, flavo, minutissime papilloso; maculis fuscis, irregularibus, frequentibus undique picto».

This phyllidiid is oval and almost elliptic, flat, yellowish, and there are very small conical

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papillae on the superior part in a great number. A large number of small darker, irregular spots are present over all the mantle's surface and the colour is almost dark yellow. The foot is narrow and elliptic. The mantle is delicate and soft. I found only one specimen 35 mm long and 19 mm wide.

Species II.
Phyllidia flava. mihi.

«Ph. corpore ovali, convexo, flavo, unicolore, supra minutissime papilloso».

This species is very close to the previous species on account of the very small and numerous papillae on the mantle and the colour, but it can be distinguished by its convexity, roughness, the lack of spots, the perfectly oval shape, and the foot proportionately wider. I found three specimens at Palermo, the largest being 19 mm long, 14 mm wide and 7 mm high.

Species III.
Phyllidia depressa. mihi.

«Ph. corpore ovali, valde depresso, imo plano, rigido, fusco, unicolore, laevi, sub lente minutissime punctulato».

A large species 79 mm long, 50 mm broad and 6 mm high, oval in shape, tough, inflexible, darkish in colour [than the preceding species], almost smooth; only with a lens is it possible to see a large number of minute dots. The groove between the insertion of the foot and mantle margin is very deep. The foot is 16 mm across. Two specimens, which I offer for your examination, were found at Palermo.

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Finally, I draw your attention to two other specimens of another phyllidiid which, on the basis of shape and colour, seem to be very close to the preceding one, but the notum has numerous, very small papillae that are paler in coloration.

These specimens are smaller, only attaining 28 mm long and 16.5 mm wide. Are they just a variety or a different species? These differences might be related to age. But if this is true, I cannot understand why the papillae disappear or are replaced with simple dots. Only more observations can resolve my uncertainty.